



DSC 16-bit Hybrid Controllers

# MC56F8006

## Demo board user's guide

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# Preface

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This reference manual describes in detail the hardware on the MC56F8006 demo board.

## Audience

This document is intended for application developers who are creating software for devices using the Freescale MC56F8006 part.

## Organization

This manual is organized into two chapters and two appendixes.

- Chapter 1, Introduction provides an overview of the demo board and its features.
- Chapter 2, Technical Summary describes in detail the MC56F8006 demo board hardware.
- Appendix A, "MC56F8006DEMO Schematics" contains the schematics of the MC56F8006DEMO board.
- Appendix B, "MC56F8006DEMO Bill of Materials" provides a list of the materials used on the MC56F8006DEMO board.

## Suggested Reading

More documentation on the MC56F8006 and the MC56F8006DEMO kit may be found at [www.freescale.com](http://www.freescale.com).

# Chapter 1

## Introduction

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### 1.1 Cautionary Notes

1. Electrostatic Discharge (ESD) prevention measures should be applied whenever handling this product. ESD damage is not a warranty repair item.
2. Axiom Manufacturing reserves the right to make changes without further notice to any products to improve reliability, function or design. Axiom Manufacturing does not assume any liability arising out of the application or use of any product or circuit described herein, neither does it convey any license under patent rights or the rights of others.
3. EMC information on the 56F8006DEMO board:
  - a. This product as shipped from the factory with associated power supplies and cables, has been tested and meets with requirements of CE and the FCC as a CLASS A product.
  - b. This product is designed and intended for use as a development platform for hardware or software in an educational or professional laboratory.
  - c. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate prevention measures.
  - d. Attaching additional wiring to this product or modifying the product's operation from the factory default as shipped may affect its performance and also cause interference with other apparatus in the immediate vicinity. If such interference is detected, suitable mitigating measures should be taken.

### 1.2 Terminology

This development board applies option selection jumpers. Terminology for application of the option jumpers is as follows:

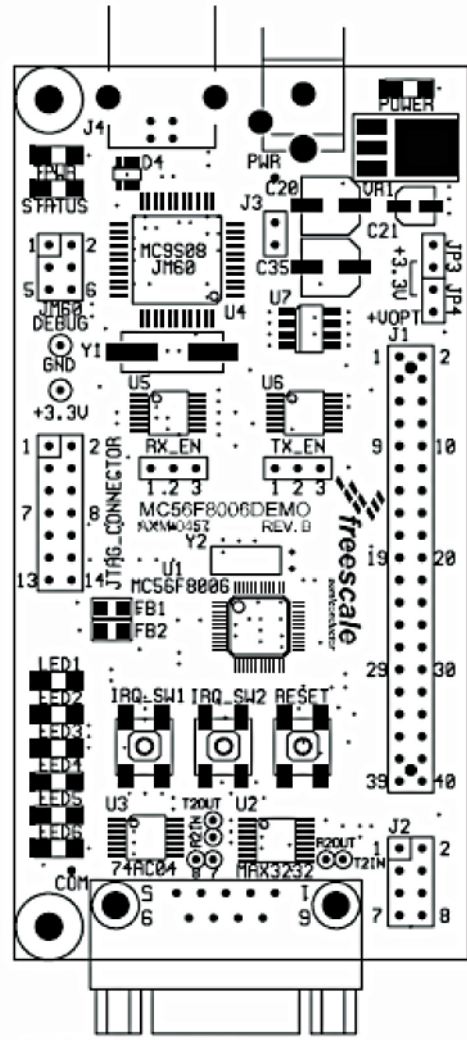
- Jumper on, in or installed = jumper is a plastic shunt that fits across two pins and the shunt is installed so that the two pins are connected with the shunt.
- Jumper off, out or idle = jumper or shunt is installed so that only one pin holds the shunt, no two pins are connected, or jumper is removed. It is recommended that the jumpers be idled by installing on one pin so they will not be lost.

This development board applies cutaway option selections. These option selections apply surface mount resistor locations with a printed circuit board trace connecting both component pads. This type of connection places an equivalent 0  $\Omega$  type resistor in series with the I/O signal and the user component or I/O connector on the board. These connections may be cut with a razor blade or similar type knife between the component pads to isolate the default connection provided. Reconnection of the cutaway type pads can be made by either installing a 0  $\Omega$  0805 size surface mount resistor or a small wire jumper on the component pads.

### 1.3 Features

The MC56F8006DEMO provides a low cost application and development platform for the MC56F8006 DSC.

- MC56F8006 DSC
  - 48-pin package, 40 GPIO
  - 16 KB flash memory
  - 2 KB RAM
  - 3 analog comparators
  - 2 analog-to-digital converters, 12-bit
  - Up to 24 inputs
  - 2 programmable gain amplifiers
  - 6 pulse-width modulator (PWM) outputs possible
  - 4 PWM fault inputs possible
  - Inter-integrated circuit (I<sup>2</sup>C)
  - Serial peripheral interface (SPI)
  - Serial communications interface (SCI)
  - Programmable interrupt timer (PIT)
  - Programmable delay block
  - 2 general-purpose timers (GPT)
  - Computer operating properly (COP) timer
  - Phase-locked loop (PLL)
  - Relaxation oscillator (ROSC)
  - Real-time counter (RTC)
  - 1 kHz oscillator
  - Crystal oscillator
  - On-chip clock synthesis (OCCS)
  - Power management controller (PMC)
  - JTAG/EOnCE interface
- I/O Connectors
  - J1 – 40-pin DSC I/O, demo standard
  - J2 – 8-pin DSC port E connector
  - PWR jack – external supply
  - USB – BDM, power, serial connection
  - JTAG – external development port
  - COM – RS-232 port (not installed)
- Switches
  - Reset
  - IRQ SW1
  - IRQ SW2
- Indicators
  - Power indicator
  - 6 user indicators
  - 2 USB status
- Crystal Reference (Y2)
  - 32 kHz type, not populated
- Specifications
  - External power: +9V DV input voltage typical, 100 mA
  - Input voltage range: +7 to +15V DC
  - Onboard regulated +3.3V DC supply
  - Board size: 2 × 4 inches



# Chapter 2

## Technical Summary

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### 2.1 Options

#### 2.1.1 JP1: IRQ\_SW1 Input Select

JP1 is a cutaway type option on the bottom side of the DEMO board. Default connection is to MC56F8006 I/O port B2. Optional connection to port B4 is provided for user application.

#### 2.1.2 JP2: IRQ\_SW2 Input Select

JP2 is a cutaway type option on the bottom side of the DEMO board. Default connection is to MC56F8006 I/O port B3. Optional connection to port B5 is provided for user application.

#### 2.1.3 JP3: +3.3 V Enable

JP3 option installed (default) provides +3.3V regulated voltage from the onboard VR1 voltage regulator to power the DEMO board. Open this option to power the board from an external +3.3V source or from the J1 connector.

#### 2.1.4 JP4: +Vopt Enable

JP4 option installed provides a connection from J1 pin 1 to the board +3.3V power connection. This option is open/idle by default. This option may be applied to provide board +3.3 V regulated voltage to the J1 connector (JP3 installed also) or to source +3.3V from J1 (JP3 open) to power the board from a connected host platform.

#### 2.1.5 TX\_EN and RX\_EN Option Jumpers

TX\_EN and RX\_EN options provide selection of the serial port connection for the MC56F8006 SCI serial port. MC56F8006 ports B6 (RXD) and B7 (TXD) provide the SCI I/O pins for these options. Default option setting is for the USB port to support the SCI serial port. The RS-232 serial port is not populated by default but may be applied by the user if populated.

TX\_EN and RX\_EN = position 1–2 default, USB BDM serial port support.

Position 2–3 = RS-232 port.

See the support DVD for virtual terminal software to support the USB serial port.

### 2.2 User Components

#### 2.2.1 LED1: 6 Indicators

Six indicator LEDs are provided for user application indications. The LEDs are applied to the MC56F8006 I/O port A0/PWM0 to A5/PWM5 signals. Buffers are applied so that the LEDs will not load the I/O port pins during operation. LEDs are on during the applied signals logic high level. The following table provides the signal and LED reference.

LED	MC56F8006 I/O Port	LED Color
LED1	PA0/PWM0	RED
LED2	PA1/PWM1	RED
LED3	PA2/PWM2	GREEN
LED4	PA3/PWM3	GREEN
LED5	PA4/PWM4	YELLOW
LED6	PA5/PWM5	YELLOW

### 2.2.2 IRQ\_SW1 and IRQ\_SW2 Push Switches

Push switches SW1 and SW2 provide an active low signal when depressed to MCF56F8006 ports PB2 and PB3 respectively. See options JP1 and JP2 to change the input ports applied.

### 2.2.3 Y2 Crystal Reference

Y2 provides a location for an external 32 kHz can crystal to be applied to the MC56F8006. Refer to the device user manual for crystal application information. Components R47, R48, C40 and C41 must also be applied with the crystal. Refer to the MC56F8006DEMO schematic diagram for component connection details.

## 2.3 Ports and Connectors

### 2.3.1 J4: USB port

J4 will provide a single connection to power the MC56F8006DEMO board. Supporting host software for basic operation is provided on the support DVD. The current release will provide a virtual serial terminal port.

#### 2.3.1.1 STATUS and TPWR Indicators

These indicators provide USB operation status indication. Status will flash or blink to indicate operation. TPWR will be on when target power is enabled from the USB port.

### 2.3.2 PWR Jack

This connector provides external power input to the board. The PWR jack accepts a standard 2.0 ~ 2.1 mm center barrel plug connector (positive voltage center) to apply a +VIN supply of +5 VDC to +12V. Also review option jumper JP3 and JP4 operation for power application. External power is not required when applying the USB development port, J4.2.3.2.1 POWER Indicator The POWER indicator will be on when the MC56F8006DEMO board has +3.3V available for operation.

### 2.3.3 +3.3 V and GND Test Points

Test point pads are provided for access to VSS/Ground and the +3.3V power signal on the board.

### 2.3.4 COM Port

The COM port connector and supporting interface circuit is not populated by default. The USB development port J4 may provide serial port connection to the MC56F8006 SCI if wanted. Refer to the TX\_EN and RX\_EN option jumpers and the J4 USB BDM connection for more details.

Components required to apply the COM port are following:

- U2: MAX3232CPWR, TI or same, note
- COM: Generic 9 pin D-Sub connector, R/A female or socket type, .318 mount hole to PCB pin distance
- C7, C8, C9, C10 and C11: SMT 0805 0.1  $\mu$ F X7R 50V capacitors

### 2.3.4.1 COM Connector

1	1		
TXD0	2	6	6
RXD0	3	7	TP
4	4	8	TP
GND	5	9	9

The COM port is applied as a female DB9 connector for interface to the MC56F8006 internal SCI serial port via the U2 RS-232 transceiver.

COM Pin 7 and 8 Test Pads: RTS / CTS flow control connection pads are provided to apply to the U2 transceiver test pads 8 and 7 respectively to implement flow controls.

U2 pin 7 and 8 Test Pads are provided to apply MC56F8006 I/O port for the RTS/CTS flow control signals.

The 1, 4, 6 and 9 pins provide an RS-232 status to the host terminal COM port. Pins 1, 4 and 6 are connected for default status signaling to the host.

### 2.3.5 JTAG/EOnCE Port

The JTAG 14-pin connector is compatible with the Freescale OnCE development port. This connector allows the connection of a JTAG/OnCE style background debug cable for software development, programming and debugging in real time.

TDI	1	2	GND	JTAG / OnCE BDM connection
TDO	3	4	GND	
TCK	5	6	GND	
	7	8	(key)	
RESET in	9	10	TMS	
3.3V DC	11	12		
DE*	13	14	TRST* in	

Note: HOST ENABLE option must be open or idle to apply this connector.



## 2.4 J1: MC56F8006 I/O Ports

J1 provides a Freescale DEMO compatible I/O port for access to MC56F8006 I/O ports. Review for alternate signal application on the DEMO board when applying.

	+Vopt	1	2	x	
	GND/V <sub>SS</sub>	3	4	PA7/RESET*	RESET SW.
TX_EN	PB7/TXD/SCL	5	6	x	
RX_EN	PB6/RXD/SDA	7	8	x	
LED1	PA0/PWM0	9	10	PC0/ANA5	100 Ω, 0.22 nF filtered
LED2	PA1/PWM1	11	12	PC1/ANA7	100 Ω, 0.22 nF filtered
	PB4/T0/CLK0	13	14	PC2/ANA9	100 Ω, 0.22 nF filtered
	PB5/T1/FAULT3	15	16	PC3/EXT_TRIG	
IRQ_SW2	PB3/MOSI/T3	17	18	PC4/ANB8	100 Ω, 0.22 nF filtered
IRQ_SW1	PB2/MISO/T2	19	20	PC5/ANB6	100 Ω, 0.22 nF filtered
	PB0/SCLK/SCL	21	22	PC6/ANB4	100 Ω, 0.22 nF filtered
	PB1/SS/SDA	23	24	PC7/ANB_5	
	PD0/TDI	25	26	PB1/SS/SDA	J1 pin 23
4.7K Ω pullup	PD1/TDO	27	28	PB0/SCLK/SCL	J1 pin 21
4.7K Ω pullup	PD2/TCK	29	30	PA2/PWM2	LED3
4.7K Ω pullup	PD3/TMS	31	32	PA3/PWM3	LED4/Y2 option
	PA6/FAULT0	33	34	PA4/PWM4	LED5
	x	35	36	PA5/PWM5	LED6
Y2 option	PF0/XTAL	37	38	PF1/CMP1_P3	
	PF2/CMP0_M3	39	40	PF3/CMP0_P3	

## 2.5 J2: MC56F8006 I/O Port E

J2 provides the connections to MC56F8006 I/O port E.

PE0	1	2	PE1/ANB_9
PE2/ANB_7	3	4	PE3/ANA_10
PE4/ANA_6	5	6	PE5/ANA_8
PE6	7	8	PE7/CMP1_M3

# Appendix A

## MC56F8006DEMO Schematics

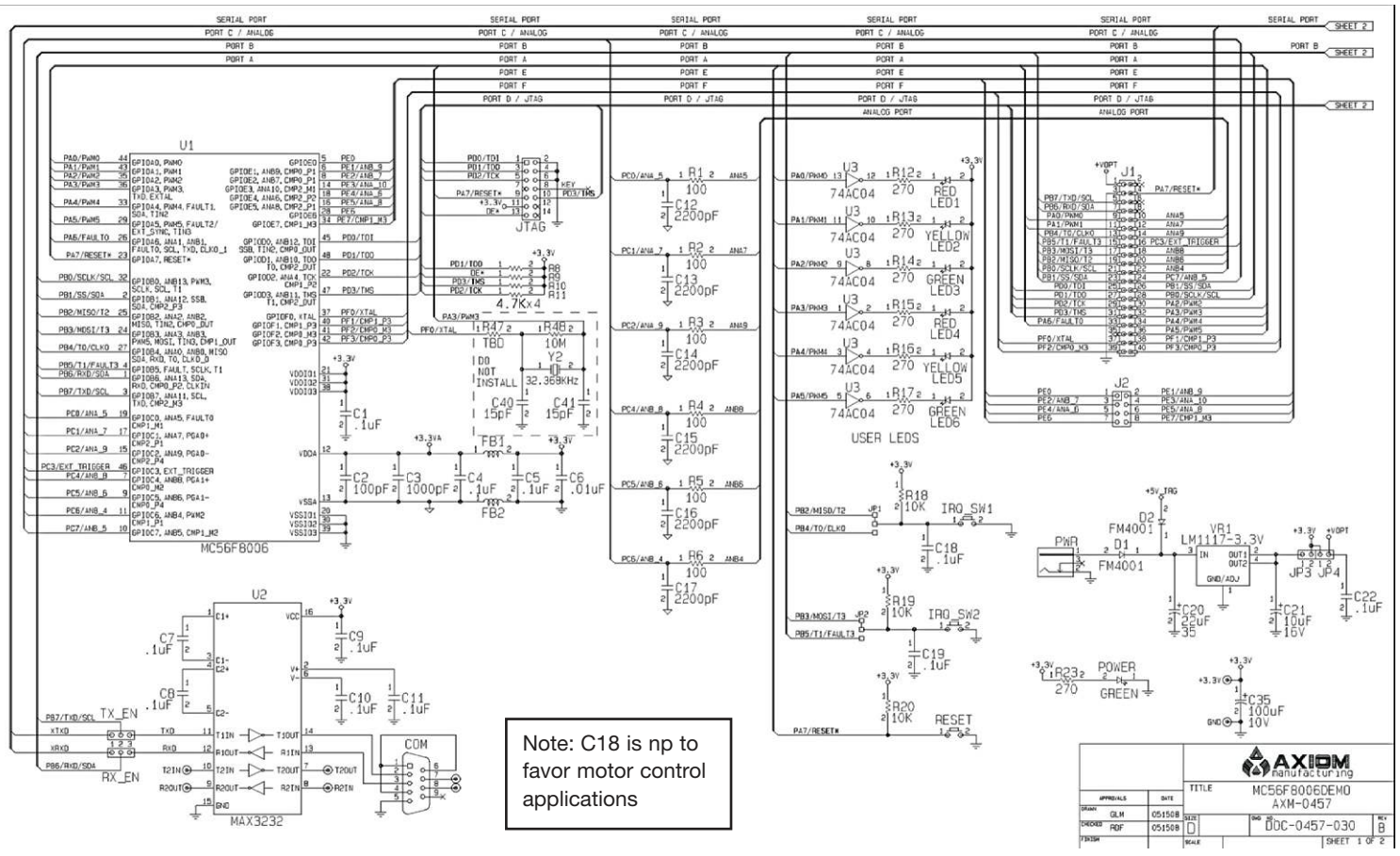


Figure A-1. MC56F8006DEMO Schematic: Part 1

REVISED		DATE	TITLE	
0001	01	05/15/08	MC56F8006DEMO	
0002	02	05/15/08	AXM-0457	
0003	03		DDC-0457-030	REV B
DESIGNED BY				SHEET 1 OF 2

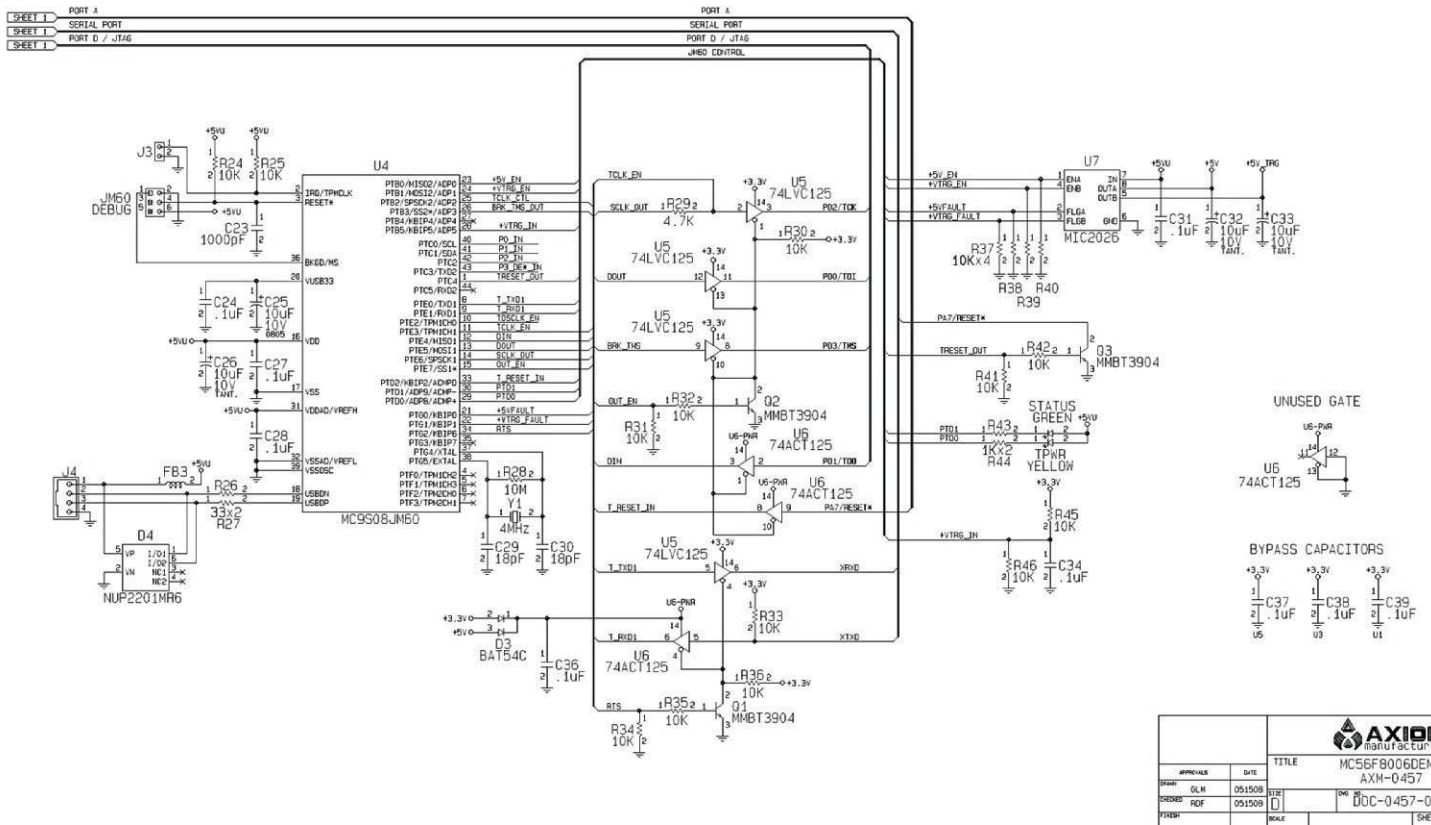


Figure A-2. MC56F8006DEMO Schematic: Part 2

# Appendix B

## MC56F8006DEMO Bill of Materials

Qty	Detail	Reference(m)	Mfr	Mfr P/N
1	(0603) 100 pF,50V	C2	Meritek	MA0603XR101K500
2	(0603) 1000 pF, 50V	C3, C23	Meritek	MA0603XR102K500
1	(0603) 0.01 $\mu$ F, 50V	C6	Meritek	MA0603XR103K500
15	(0603) 0.1 $\mu$ F,16V	C1, C4, C5, C18, C19, C22, C24, C27, C28, C31, C34, C36–C39	Meritek	MA0603XR104K160
1	(0805) 10 $\mu$ f,10V, X5R, 10%	C25	Epcos	B37641C8106K062
2	(0603) 18 pF, 50V, npo/cog, 5%	C29, C30	Meritek	MA0603CG180J500
6	(0603) 2200 pF, 50V	C12–C17	Meritek	MA0603XR222K500
1	(SMA) 10 $\mu$ F, 16V, 3x5	C21	Nichicon	UWX1C100MCL2GB
1	(SMD) 100 $\mu$ F, 10V, 6x5	C35	Nichicon	UUD1A101MCL1GS
1	(SMD) 22 $\mu$ F, 35V, 6x5	C20	Panasonic	EEE-1VA220SP
3	(SMA) 10 $\mu$ F, 10V	C26, C32, C33	AVX	TAJA106K010R
2	(SMA) FM4001, Rectifier, 50V, 1A	D1, D2	Rectron	FM4001-W
1	(Sot23) BAT54C, Schtky, 30V, 200 mA, Dual Com Cat	D3	Micro Elec	BAT54C
4	(1206) Green	LED3, LED6, Power, Status	Micro Elec	150YG
2	(1206) Red	LED1, LED4	Micro Elec	150SR
3	(1206) Yellow	LED2, LED5, Tpw	Micro Elec	150HY
1	(Tsop6) NUP2201, TVS-Array, 500 W	D4	On Semi	NUP2201MR6T1G
1	Plug 2 mm Barrel, RA	Pwr	Vimex	SCD-014-PB
3	1x2 Header	J3, Jp3, Jp4	Keltron	PH1-2S-G-F1
2	1x3 Header	Rx_En, Tx_En	Keltron	PH1-3S-G-F1
1	2x3 Header	JM60 Debug	Keltron	PH2-6S-G-F1
1	2x4 Header	J2	Keltron	PH2-8S-G-F1
1	2x7 Header	JTAG	Keltron	PH2-14S-G-F1
1	2x20 Header Socket, Pass Thru	J1	E-Call	0161-2819-400
1	USB-B, RA	J4		
3	(0805) 330 $\Omega$ @ 100M, 1.5A	FB1–FB3	Murata	BLM21PG331SN1D
3	(Sot23) MMBT3904, 40V, 350 mW	Q1–Q3	Taitron	MMBT3904
6	(0603) 100 $\Omega$ , 5%	R1–R6	Meritek	CR16-101J
2	(0603) 1 k $\Omega$ , 5%	R43, R44	Meritek	CR16-102J
20	(0603) 10 k $\Omega$ , 5%	R18–R20, R24, R25, R30–R42, R45, R46	Meritek	CR16-103J
1	(0603) 10 M $\Omega$ , 5%	R28	Meritek	CR16-106J
7	(0603) 270 $\Omega$ , 5%	R12–R17, R23	Meritek	CR16-271J
2	(0603) 33 $\Omega$ , 5%	R26, R27	Meritek	CR16-330J
5	(0603) 4.7K $\Omega$ , 5%	R8–R11, R29	Meritek	CR16-472J
3	6 mm Sq, J Lead	Irq_Sw1, Irq_Sw2, Reset	Mtn Switch	101-0367
1	(Lqfp44) MC9S08JM60	U4	Freescale	MC9S08JM60CLD
1	(Lqfp48) MC56F8006, 16-bit	U1	Freescale	PC56F8006VLF
1	(Soic8) MIC20261YM, Dual Pwr Sw, 5V	U7	Micrel	MIC2026-1YM TR
1	(Tssop14) 74AC04, Hex	U3	TI	SN74AC04PWR
1	(Tssop14) 74ACT125, Quad	U6	Fairchild	74ACT125MTCX
1	(Tssop14) 74LVC125, Quad	U5	TI	SN74LVC125APWR
1	(Sot223) LM1117, 800 mA, LDO	Vr1	St Micro	LD1117S33TR
1	(HC49S) 4 MHz, Sht Can	Y1	Fox	FOXSDLF/040
4	0.10 Shunt	Shunts	E-Call	0146-230-020
1	Rev B MC56F8006DEMO, 2.0x4.0,2 Lyr	PCB		
0		C7–C11, C40, C41, Com, R47, R48, U2, Y2		

